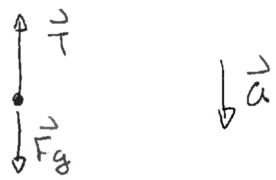
On the suspended block, acceleration is down. So $\vec{F}_{net}$ is down.



Thus $F_g > T$

$\Rightarrow Mg > T$

$\Rightarrow 10kg \times 9.8 m/s^2 > T$

$\Rightarrow T < 98N$

Also if $T=0$ then the $5.0kg$ block would not accelerate. So

$0N < T < 98N$

a)

b) $\sum F_{iy} = ma_y$

So at top $a_y = -v^2/r \Rightarrow -T - mg = -\frac{v^2}{r} m$

$\Rightarrow T + mg = \frac{v^2}{r} m$

V decreases $\Rightarrow$ T decreases.

Minimum $T = 0 \Rightarrow \cancel{m}g = \cancel{m}v^2/r \Rightarrow v^2 = gr = \; v = \sqrt{gr}$

$= \sqrt{9.8\,m/s^2 \times 0.50\,m}$

$= 2.2\,m/s$

When $T \to 0$ string slackens

c) At top $T = m\left(\frac{v^2}{r} - g\right)$

At bottom $a_y = v^2/r \Rightarrow T - mg = m\frac{v^2}{r} \Rightarrow T = m\left(\frac{v^2}{r} + g\right)$

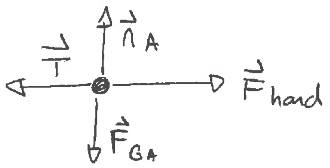
Clearly larger at bottom.

d) Bottom: $T - mg = mv^2/r \Rightarrow \frac{Tr - mgr}{m} = v^2$

$\Rightarrow v = \sqrt{\frac{T - mg}{m} r} \Rightarrow v = 2.8\,m/s$

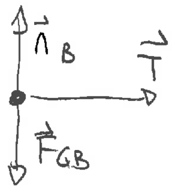
Knight Ch 7
Conc Q 13

A



$\vec{F}_{net} = \vec{F}_{hand} + \vec{T} = m_A \vec{a}$

B



$\Rightarrow \quad \vec{F}_{net} = m_B \vec{a} \Rightarrow \vec{T} = m_B \vec{a}$

The accelerations are the same $\Rightarrow \vec{F}_{hand} + m_A \vec{a} = m_B \vec{a}$

$\Rightarrow \vec{F}_{hand} = (m_B - m_A)\, \vec{a}$

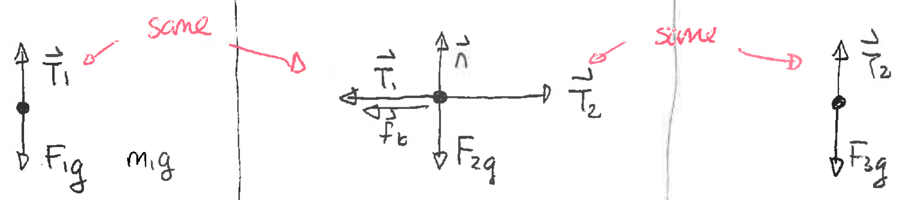
So accelerates to right. Thus $F_{hand} > T$. So smaller than

Alternatively

The pair will accelerate right. Thus on the right hand block $\vec{F}_{net}$ is $\rightarrow$
So using the FBD for A, $F_{hand} > T$ (if not the acceleration would be zero or to left).

Knight Ch 7 *

4^{ed} Prob 38



1.0kg block

accel $\uparrow \vec{a}$ $\quad a_x = 0$, $a_y = a$

$$\Sigma F_y = m_1 a_y$$

$$\Rightarrow T_1 - m_1 g = m_1 a$$

$$\Rightarrow T_1 - 1.0\text{kg} \times 9.8\text{m/s}^2 = 1.0\text{kg}\, a$$

$$\Rightarrow T_1 - 9.8\text{N} = 1.0\text{kg}\, a$$

Solve for T_1

$$T_1 = 9.8\text{N} + 1.0\text{kg}\, a$$

2.0kg block.

accel $\vec{a} \rightarrow$ $\quad a_x = a$, $a_y = 0$

$$\Sigma F_x = m_2 a_x$$

$$\Rightarrow T_2 - T_1 - f_k = m_2 a$$

$$T_2 - T_1 - \mu_k n = 2\text{kg}\, a$$

$$\Sigma F_y = 0$$

$$\Rightarrow n - F_g = 0$$

$$\Rightarrow n = m_2 g = 2.0\text{kg} \times 9.8\text{m/s}^2$$

$$n = 19.6\text{N}$$

$$T_2 - T_1 - 0.30 \times 19.6\text{N} = 2\text{kg}\, a$$

$$T_2 - T_1 - 5.9\text{N} = 2\text{kg}\, a$$

3.0 kg block

accel $\downarrow \vec{a}$ $\quad a_x = 0$, $a_y = -a$

$$\Sigma F_y = m_3 a_y$$

$$T_2 - m_3 g = m_3(-a)$$

$$T_2 - 3.0\text{kg} \times 9.8\text{m/s}^2 = -3.0\text{kg}\, a$$

$$\Rightarrow T_2 - 29.4\text{N} = -3.0\text{kg}\, a$$

Solve for T_2

$$T_2 = 29.4\text{N} - 3.0\text{kg}\, a$$

substitute

$$29.4\text{N} - 3.0\text{kg}\, a - (9.8\text{N} + 1.0\text{kg}\, a) - 5.9\text{N} = 2\text{kg}\, a$$

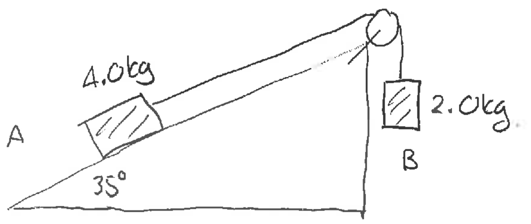
$$\Rightarrow 29.4\text{N} - 9.8\text{N} - 5.9\text{N} - 4.0\text{kg}\, a = 2.0\text{kg}\, a$$

$$\Rightarrow 13.7\text{N} = 6\text{kg}\, a$$

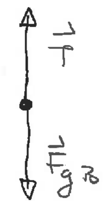
$\Rightarrow a = \frac{13.7N}{6.0kg} \Rightarrow a = 2.3\,m/s^2$

Knight Ch 7

4ed Prob 40



a) In this case B is at rest.



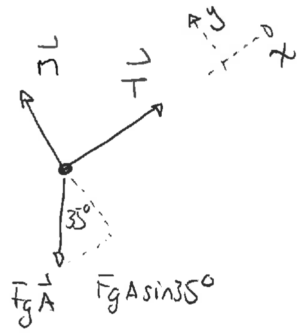
$\Rightarrow \vec{a} = 0$

$\sum F_y = ma_y = 0$

$\Rightarrow T = F_{gB} = M_B g \Rightarrow T = 2.0kg \times 9.8m/s^2 = 19.6N$

b) Need to consider A

Use tilted axes



$\sum F_x = M_A a_x$

$\sum F_y = M_A a_y$

	x	y
$\vec{n}$	0	n
$\vec{T}$	T	0
$\vec{F_g}$	$-M_A g\sin35°$	$M_A g\sin35°$

$\Rightarrow T - M_A g\sin 35° = M_A a_x$

$\Rightarrow T - 4.0kg \times 9.8m/s^2 \sin35° = 4.0kg\, a_x$

$\Rightarrow T - 22.5N = 4.0kg\, a_x$ Let $a_x \equiv a \Rightarrow T - 22.5N = 4.0kg\, a$

For B acceleration is vertical. So $a_y = -a$

$\sum F_y = M_B a_y \Rightarrow T - F_{gB} = M_B(-a) \Rightarrow T - 19.6N = -2.0kg\, a$

Eliminate T: $T = 22.5N + 4.0kg\, a$

$T = 19.6N - 2.0kg\, a$

These give $22.5N + 4.0kg a = 19.6N - 2.0kg a$

Thus

$$2.9N = -6.0kg\, a$$

$$\Rightarrow -\frac{2.9}{6.0kg} = a \quad \Rightarrow \quad a = -0.48 m/s^2$$

This is down the slope. If the object were at rest it would start to move down the slope.

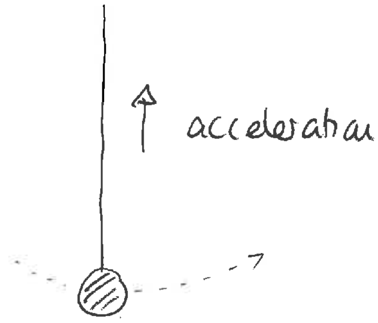
c) $T = 22.5N + 4.0kg\, a$

$$\Rightarrow T = 22.5N + 4.0kg \times (-0.48 m/s^2)$$

$$T = 21\,N$$

Knight Ch8

Conc Q 4



$\vec{F}_{net} = m\vec{a} \Rightarrow \vec{F}_{net}$ up

FBD

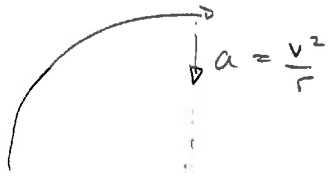
$\vec{F}_{net} = \vec{T} + \vec{F}_G$

$\Rightarrow T$ larger than F_G.

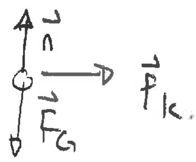
Knight Ch 8

~~Prob 8~~

4ed Prob 6



viewed from side

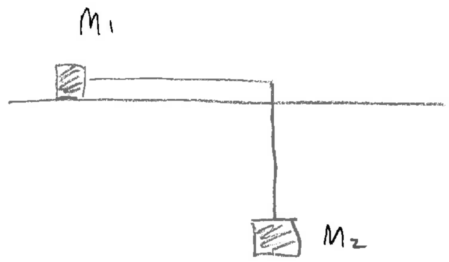


$$\vec{F}_{net} = m\vec{a} \Rightarrow \vec{f}_k = m\vec{a}$$

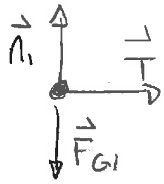
$$\Rightarrow f_k = \frac{mv^2}{r} = \frac{1500\,kg\,(15\,m/s)^2}{50\,m}$$

$$= 6.8 \times 10^3\,N$$

Knight Ch 8
~~Prob 48~~
4^{ed} Prob 13



Mass m_1



$$\sum \vec{F}_i = m\vec{a} \Rightarrow \sum F_{ix} = m a_x \Rightarrow T = m_1 a = m_1 v^2/r$$

$$\sum F_{iy} = m a_y = 0 \Rightarrow n_1 = m_1 g$$

Mass m_2

Stationary $\Rightarrow \vec{a} = 0$

$$\sum \vec{F}_i = m\vec{a}$$

$$\Rightarrow \vec{T} + \vec{F}_{G2} = 0$$

$$\Rightarrow T - m_2 g = 0 \Rightarrow T = m_2 g$$

Combine $T = \dfrac{m_1 v^2}{r}$ and $T = m_2 g$

$$\Rightarrow \frac{v^2 m_1}{r} = m_2 g \Rightarrow v = \sqrt{\frac{m_2}{m_1} g r}$$